

# Web Based Implementation of Interactive Computer Assisted Legal Support System - Analysis Design Prototype Development and Validation of CALLS System

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**Abstract.** This paper explains about how lawyers retrieve information in the process of legal research and reasoning. CALLS (Computer Aided Legal Support System), is a reasoning method for determining similar cases by executing a case-similarity calculation step and utilizing a distribution of values of fields for calculation of reasoning results of cases having high similarities. Since the similar cases are determined taking a peripheral distribution of a new case into consideration, suitable similar cases can be selected for reasoning even when the case distribution is not uniform. we have implemented a web based Case-Based Reasoning (CBR) legal support system that generates a query to the legal support system by using information derived from CBR analysis of a problem situation. The query is automatically formed by submitting in text form a set of highly relevant cases, based on a CBR analysis, to a case base relevance feedback module. This approach extends the reach of CBR, for retrieval purposes, to much larger corpora and injects knowledge-based techniques into case base retrieval system. The main objective of the paper is to explain the analysis design, prototype implementation and validation method of computer assisted legal support system. Current working system is implemented in PHP with MySQL; still work is under process by adding more cases to improve the performance of the system.

**Keywords:** Case Based Reasoning, Case Management , Knowledge base

## 1. Introduction

The law is an attractive domain for AI research for several reasons. First, the law has a tradition of examining its own reasoning process. Second, legal reasoning is stylized: one reason according to stare decisis, with cases and by analogy. Third, much legal knowledge is readily accessible and relatively well structured, codified and indexed. Nevertheless it will not surprise, and may even please, lawyers to learn that the Restatement, the Uniform Commercial Code, and case law, like the theories of legal reasoning proposed by Karl Llewellyn and H. L. A. Hart, are of limited immediate use to AI programmers [1][2].

Artificial Intelligence can act as: "A solution to the problem of legal complexity". Computer programs can indeed solve legal problems. The fact that computer programs can model law is not necessarily simply of academic interest. Automated case research is one potential application of intelligent programs. When artificial intelligence determines a solution to a legal problem, it could then automatically fetch relevant cases from online or off-line statutory and case law databases.

With the advent of computers and artificial intelligence (AI), both the range of techniques available and the practical motivation for creating legal reasoning models have grown. In particular, researchers have made significant advances in modeling the way lawyers classify, analyze and argue with cases, using a variety of computational approaches including frames, transition nets, semantic networks, discrimination trees, and

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neural networks. Strength of case-based legal reasoning has led to significant advances in modeling the way lawyers use previously decided cases. Some models generate legal arguments that to some degree simulate human adversarial discourse. The attempts in developing intelligent systems in the domain of law were boosted by HYPO [3] -- a CBR system that creates legal arguments from a case base on the domain of trade secret law. There have been different research works carried on to retrieve legal text and cases. Gardner [4] in her doctoral dissertation attacked the problem of identifying “hard” and “easy” questions in the context of analyzing fact situations from law school exams on the contracts law of offer and acceptance. Branting and Lester [5], describe the design task of document drafting that requires complex adaptation for case reuse. In their approach, they demonstrate the illocutionary and rhetorical structures of self-explaining documents. Daniels and Rissland [6] built a hybrid CBR and Information Retrieval (IR) system where the CBR technology plays the role of improving the query presented to the IR system, improving the results.

The main aim of the paper is to build a web based CBR based system to retrieve similar legal cases from the past decision made cases. The paper is organized as follows: In the next section, we explain the research objective of the working prototype. CALLS components are described in Section 3. Section 4 describes the implementation process of web based CALLS system. Section 5 explains the working system with sample screenshots; finally the work is concluded in Section 6.

## **2. Research Objective**

Strength of case-based legal reasoning has led to significant advances in modeling the way lawyers use previously decided cases [7]. Some models generate legal arguments that to some degree simulate human adversarial discourse. The main objectives of developing the prototype are as follows [8]:

- Representation of cases, including what information should be included (facts, issues, holdings, results, and justification) and what formalism(s) should be used.
- Organization of the case base (including indexing attributes and index structure) and retrieval of cases that is potentially relevant to a new case.

## **3. CALLS components**

### **3.1. Case Input Module**

First, a problem case is input and analyzed to see what dimensions, sometimes also called factors, are applicable in the problem case. Dimensions address important legal aspects of cases and are used both to index and compare cases. They represent different argumentative approaches for dealing with an issue

### **3.2. Knowledge Base Module**

Second, any case in the case-knowledge-base sharing at least one applicable dimension with the problem case is retrieved. These are considered the minimally relevant cases.

### **3.3. Case Similarity Module**

Third, these relevant cases are sorted according to a model of on-pointness. In this sorting, which results in a partial order, Case A is considered more on-point than Case B if the set of applicable dimensions. A shares with the problem case properly contains those shared by B and the problem case. Maximal cases in this ordering are called most on-point cases or mopc's. The result of sorting the cases can be shown in a so-called claim lattice. Those cases on the top level of the lattice are the mopc's. The problem case is the root node. Our CBR systems use the claim lattice as a starting point for various other aspects of CBR, such as the generation of arguments or creation of hypotheticals.

However, in this paper, we have implemented the first two modules of querying the problem and retrieving the cases. Next level of work will be adding weights and showing the results in sorting order of claim lattice.

## **4. Prototype Implementation**

The Web based CALLS system methodology is shown in figure below. It contains four main phases: requirement and planning, system design and architecture, coding and testing. These four phases are carried in cycle manner until the product is developed. The cycle manner is necessary for reassuring each phase satisfaction.

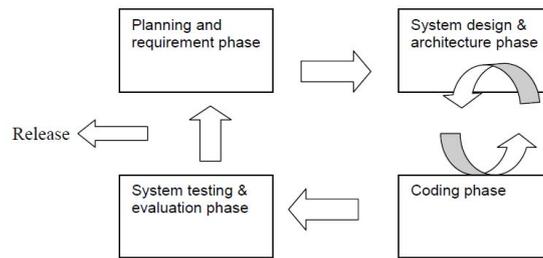


Fig. 1 illustrates the Prototype Implementation

#### 4.1. Planning and Requirement

##### a) Functional Requirement

- Login: Users need to enter the username and password to login and identify their user power whether is administrator or normal user.
- Registration: A normal user needs to be registered by administrator so that s/he has an account to access the system.
- Case Management: Only the administrator can access this part to manage the cases in the database. All the cases (PDF files) and the details of the cases can be uploaded and edited by administrator.
- Search Knowledge Base: Knowledge Bases is a group or a set keyword that to let user search by knowledge bases.
- Keyword Management: Keyword Management is an internal function that filtering keyword during multiple keyword searches.

##### b) Non Functional Requirement

- Performance: The performance of the CALLS system is faster reliable and accurate while retrieving the similarity of cases..
- Security: The security of the CALLS system is encrypted with passwords to disallow third party to access the system.
- Consistency: By replicating the manner in which decisions are made, decision support systems are encouraging the spread of consistency in legal decision making.
- Transparency By demonstrating how legal decisions are made, legal decision support systems are leading to better community understanding of legal domains. This has the desired benefit of decreasing the level of public criticism of judicial decision making.

#### 4.2. System Design

The current system is web based design architecture. Below figure illustrates the design flowchart of the working system.

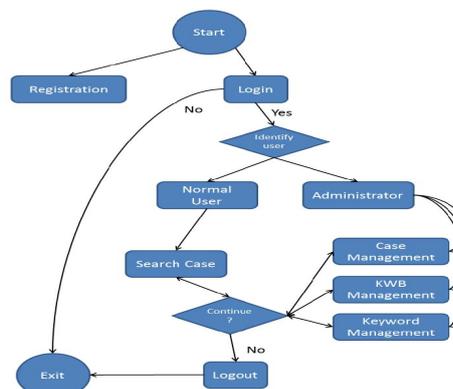


Fig. 2 illustrates the Web Based Calls Design Flowchart

### 4.3. Database Design

Database designed with three normalizations whereas the data dictionary is provided with all relevant fields and their attributes and lengths. The dictionary compares perfectly to the database that will be implemented to store and recover CALLS data.

Table 1: Calls Database

Table Name: tbluser  
Table Definition: store user account info

Column Name	Column Type	Column Attribute	Column Definition
username	VARCHAR(45)	NOT NULL, PRIMARY KEY	User access id
password	VARCHAR(45)	NOT NULL	User access password
name	VARCHAR(45)	NOT NULL	User's name
userpower	TINYINT(1)	NOT NULL	User power to access CALLS

Table 3: Knowledgebase

Table Name: tblkwb  
Table Definition: store knowledge based info

Column Name	Column Type	Column Attribute	Column Definition
idtblkwb	INT	NOT NULL, PRIMARY KEY	Knowledge based id
kwbName	VARCHAR(200)	NOT NULL	Knowledge based name
kwbDesc	VARCHAR(200)	NOT NULL	Knowledge based description

Table 2: Table Case

Table name: tblcase  
Table Definition: store cases

Column Name	Column Type	Column Attribute	Column Definition
filename	VARCHAR(200)	NOT NULL, PRIMARY KEY	Document name
plaintiff	VARCHAR(45)	NULL	Case's plaintiff
act	VARCHAR(45)	NULL	Case's act
facts	VARCHAR(1000)	NULL	Case's fact
d2	VARCHAR(1000)	NULL	Case's Legal Issue
d3	VARCHAR(1000)	NULL	Case's decision/opinion
casedate	INT(4)	NULL	Case's date
concept_descr	VARCHAR(1000)	NULL	Case's concept description

Table 4: Keyword Search

Table Name: tblkeyword  
Table Definition: store unwanted keyword in search

Column Name	Column Type	Column Attribute	Column Definition
idtblkeyword	INT	NOT NULL, AUTO_INCREMENT, PRIMARY KEY	Keyword's id
keyword	VARCHAR(200)	NOT NULL	Keyword name

## 5. Sample Outputs

The Web based CALLS system is developed partially with flexible user interface and accuracy of retrieving the similar cases is reliable on testing the prototype. The system is uploaded with 15 cases for initial stage of testing and performed the functionality of querying the cases and retrieving the similar cases. The case search and similarity will be enhanced in next level of work by adding more cases in the database.

### 5.1. Implementation

The system is implemented with PHP & MySQL, supporting tools which include HTML, JavaScript and Ajax. The developed working prototype can support all type of browser with minimum hardware requirements. Sample system interface screen shots are shown in below figures.

#### 5.1.1. Case Management

First, cases need to be uploaded in the database. If there are no cases, system is unable to retrieve the output, Administrator and staffs are the level of user to provide permission for uploading the cases. In addition, Case Management allows users to edit or delete cases.

**Computer Aided Legal Support System (CALLS)**  
Prototype Development and Validation

Welcome, tsadmin Logout

Site Menu  
Home

Management  
Add New Case  
Case Management  
New Knowledge Base  
Knowledge Base Management

**Add New Case**

Case Name:

Plaintiff:

Act:

Case Year:

Facts:

Legal Issue:

Decision / Opinion:

Citation Cases:

Concept Description:

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Figure 3 uploading a case

### 5.1.2. Knowledge Base Management

Knowledge Bases is a group or a set keywords that allow users to search from knowledge bases and retrieve the cases. For example, if user want the cases the related about 'criminal'. System will able to provide the cases with 'criminal' through knowledge base module. Knowledge Bases Management also eliminates certain information which doesn't exist in the knowledge Base. Administrators have the access to customize the knowledge base information.



Fig. 4: Knowledge Base Management

### 5.1.3. Case Search

The search part is core module of the CALLS. It allows user to query the cases and retrieve the queried base through case search module. CALLS are provided five type of search method, which are text/phrase, date, plaintiff, act and knowledge base. Date, plaintiff, act are the attributes of case search, but text/phrase is search for case's document. Text/phrase will able to return content of cases that matches with user's keyword. If CALLS unable to retrieve the result, it will break down the keyword, or multiple keyword searches, and able to return the cases that as possible match with user's keyword. Knowledge based search is same with text/phrase searching method, it is searches through content of cases, but it will allow user to choose the knowledge that is defined by administrator, and return the cases that related with knowledge.

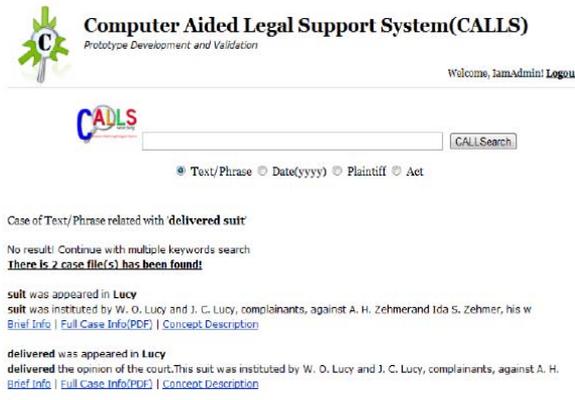


Fig. 5: Case Search

### 5.1.4. User Registration

Registration allows user to register an account to access the CALLS system. Two level of users are in CALLS, which is normal user includes lawyer or researcher's allow user to make the search, and Administrator upload and manage the cases.



Fig. 6: User Registration

## 6. Conclusion

The growing rise in the number of litigants who represent themselves in court has undesirable consequences for the administration of justice. Our approach to help alleviate this problem is to develop web-based legal support systems. While our research has been primarily devoted to developing legal decision support systems by Case Base Reasoning approach, we are of the view that the systems developed can help deliver improved access to justice. We have illustrated the working functionality of CALLS system and explained the software development life cycle of the system. Currently system is developed with limited cases; in future more cases will be added for the enhancement of the system. Current research can be demonstrated in diverse range of law and it will be compared with existing systems.

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## 8. References

- [1] L. Thorne McCarty., Example Generation. In Third Biennial Conference of the Canadian Society for Computational Studies of Intelligence, University of Victoria, Victoria, B.C, 1980
- [2] Hart H L A , Positivism and the Separation of Law and Morals. 71 Harvard Law Review 593, 1958
- [3] Ashley, K. D., Modeling Legal Argument: Reasoning with Cases and Hypothetical's, Bradford Books/MIT Press: Cambridge, MA, 1990.
- [4] Gardner, A., An Artificial Intelligence Approach to Legal Reasoning, Bradford Books/MIT Press: Cambridge, MA, 1990.
- [5] Branting., L. Karl & Lester, James C, "Justification Structures for Document Reuse Advances in Case-Based Reasoning", third European Workshop, EWCBR-96, Lausanne, Switzerland, November 14-16, 1996.
- [6] E. L. Rissland., J. J. Daniels, Z. B. Rubinstein, and D. B. Skalak," Case-Based Diagnostic Analysis in A Blackboard Architecture", In Proceedings, The 11th National Conference on Artificial Intelligence, pages 66–72, WashingtonD.C, July 1993.
- [7] Kolodner, J, Case-Based Reasoning. Morgan Kaufmann, Los Altos, CA,1993.
- [8] Raman Valliappan , Ayyappan Palanissamy, "COMPUTER AIDED LEGAL SUPPORT SYSTEM: An Initial Framework for Retrieving Legal Cases by Case Base Reasoning Approach", in IEEE 5th International Conference on Innovations in Information Technology, Dec 16-18, UAE, 2008.